

ROOFING PANEL SYSTEM

Technical Field

5 The invention relates to the field of roofing and siding, and more particularly to a system of interlocking panels that can be used for roofing and/or siding applications.

Background

10 Roofing and siding panels of various kinds are known. Such panels are generally fabricated with raised decorative elements simulating classic roofing and siding materials such as, for example, shake, tile, brick, stone, and slate. Such panels may be fabricated from thermoplastic sheets, by injection molded plastics, fiberglass molding, and metal, among other materials. In comparison to real wood shakes or
15 tiles, such panels are generally easier to install, require less care, provide a reduced fire hazard, and provide greater durability.

Summary of Invention

20 A roofing system according to the present invention includes high-profile panels made from recycled rubber tire crumb and recycled industrial polymers such as polyethylene and polypropylene or other virgin plastics.

25 The panels incorporate a longitudinal locking mechanism along the length of their front and back edges that allows each panel to lock to its neighbor to produce a weather-resistant closure. This longitudinal locking mechanism allows the panels to be continuously staggered to avoid any repetition of pattern that would be unappealing to the eye of the beholder. The portion of the longitudinal locking mechanism along the rear edge of a panel protrudes upward, while the portion of the
30 longitudinal locking mechanism along the front edge is a longitudinal cavity within an indented region on the underside of the panel, into which the rear edge of an adjacent panel can latch. This longitudinal

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locking mechanism allows the panels to expand and contract and tighten with exterior forces, such as wind.

Fasteners, for example nails or screws, may be used to fasten each panel to a substrate along its rear edge through a nailing flange in marked preferred locations. All such fasteners are protected by the longitudinal locking mechanism against exposure to the elements.

The panels also have transverse locking mechanisms on each side, adapted so that adjacent panels can be locked together in a side-to-side manner. This transverse locking mechanism may be a hook and lap arrangement, which offers a tight lock and easy alignment of the panels during installation.

When interlocked together, the panels offer protection against wind, rain, and other elements of nature. Built-in cavities along the front edge of the panels and in front of the longitudinal locking mechanism diffuse wind-driven rain pressures and resist the entry of rain along the front edge of the panel. If rain were to get past these cavities, it would be quickly diffused when it reached the longitudinal locking mechanism and would drain naturally away.

Additionally, the panels have supports built into the under surface that evenly distribute forces to the substrate when the panels are walked upon.

The undersurface is also specially designed with an integrated venting system that allows for continual air flow under the panel, reducing the possibility for moisture build-up from underneath, which is a common source of wood rot or mold.

The panels can be manufactured to look like wood cedar shakes, concrete tile, Spanish tile, Italian tile, slate and other textures on their top and/or front visible surfaces. Many other designs may be imparted to the visible surfaces as may be required or desired. The panels can be colored to numerous synthetic colors to emulate the colors of nature – for example, greys, black, or browns.

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The panels' polymer and rubber matrix makes them flexible and gives them a high coefficient of expansion and contraction. Being composed of recycled materials, the panels may be an environmentally friendly and cost-competitive alternative to natural products. Additionally, the panels are themselves recyclable; if ever a panel has to be recycled, it can simply be re-ground and reprocessed. The durability and resistance to ultra-violet radiation of the polymer matrix offer an extended life expectancy of about 50 years.

The panel design allows for easy application, thus cutting labor costs and installation times. Because each panel contains an assembly of three to five pieces of textured decorative elements (for example, simulated shakes or tiles), they are easy to handle and install. For example, the panels can be made about 16 inches by 40 inches (40 cm. by 100 cm.), with an exposed surface when installed of about three square feet (300 square cm.) and a thickness of about 1.8 inches (4.5 cm.) at the thickest protrusion.

While the most common usage of the panels is for roof applications, they may be also used for other applications – for example as siding.

Accessory caps may be used on roof applications in respect of changes of direction on various types of roofs – for example, on gables, ridges, hips, or valleys, otherwise to cover any change in direction where there are exposed edges of panels. These accessory caps incorporate similar design features as the panels.

Brief Description of Drawings

Figure 1 is a top plan view of a panel embodying aspects of the present invention.

Figure 2 is a front elevational view of the panel of Figure 1.

Figure 3 is a bottom plan view of the panel of Figure 1.

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Figure 4 is a top, left, front oblique view of a system of panels formed by connecting together a plurality of the panels of Figure 1.

Figure 5 is a bottom, left, front, oblique view of the system of panels of Figure 4.

5 Figure 6 is a top plan view of the system of panels of Figure 4.

Figure 7 is a bottom plan view of the system of panels of Figure 4.

Figure 8 is a cross-sectional side view of the panel of Figure 1 taken along lines 8-8 of Figure 1.

10 Figure 9 is an enlarged cross-sectional side view of the longitudinal protrusion portion of the panel of Figure 8, which forms one half of the longitudinal locking mechanism.

Figure 10 is an enlarged cross-sectional side view of the longitudinal cavity portion of the panel of Figure 8, which forms the other half of the longitudinal locking mechanism.

15 Figure 11 is a cross-sectional view of two interconnected panels taken along lines 11-11 of Figure 6.

Figure 12 is an enlarged cross-sectional view of the longitudinal locking mechanism connecting the two panels of Figure 11.

20 Figure 13 is a front elevational view of two adjacent panels showing a transverse locking mechanism for interconnecting the two panels.

Figure 14 is a top, right, front oblique view of a roof having installed thereon a plurality of interlocked panels and accessory caps embodying aspects of the invention.

25 Figure 15 is a top plan view of the roof of Figure 14.

Figure 16 is a right elevational view of the roof of Figure 14.

Figure 17 is a top, right, front oblique view of a ridge cap embodying aspects of the invention.

30 Figure 18 is a bottom, right, front oblique view of the ridge cap of Figure 17.

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Figure 19 is a front elevational view of the ridge cap of Figure 17.

Figure 20 is a top plan view of the ridge cap of Figure 17.

Figure 21 is a bottom plan view of the ridge cap of Figure 17.

5 Figure 22 is a cross-sectional side view of the ridge cap of Figure 17 taken along lines 22-22 of Figure 20.

Figure 23 is a top, right, front oblique view of a hip cap embodying aspects of the invention.

10 Figure 24 is a bottom, right, front oblique view of the hip cap of Figure 23.

Figure 25 is a front elevational view of the hip cap of Figure 23.

Figure 26 is a top plan view of the hip cap of Figure 23.

Figure 27 is a bottom plan view of the hip cap of Figure 23.

15 Figure 28 is a cross-sectional side view of the hip cap of Figure 23 taken along lines 28-28 of Figure 26.

Description

Throughout the following description specific details are set forth in order to provide a more thorough understanding of the invention.

20 However, the invention may be practised without these particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the present invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

25 Figure 1 is a top plan view and Figure 2 is a front elevation view of a panel 10 according to an embodiment of the invention. Each panel 10 is preferably manufactured from a blend of recycled rubber tire crumb and recycled industrial polymers such as polyethylene and polypropylene or other virgin plastics. Such a polymer and rubber
30 matrix makes the panel 10 flexible and gives it a high coefficient of expansion and contraction; expansion and contraction will be minimal

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but the flexibility of the panel 10 makes it resistant to cracking or breaking. The preferred material composition also makes the panel 10 essentially impervious to water absorption or penetration. Being composed of recycled materials, a panel 10 with such a material composition
5 may be an environmentally friendly and cost-competitive alternative to natural products. Additionally, such a material composition would make the panel 10 itself recyclable. If ever a panel 10 needed to be recycled, it can be simply re-ground and reprocessed. The durability and resistance to ultra-violet radiation of a panel 10 with such a material
10 composition offer an extended life expectancy of about 50 years. A panel 10 of such a material composition also has high insulation and sound dampening qualities. It is also lightweight, reducing the stress and structural pressures on any building on which the panel 10 is installed.

15 Even so, a panel 10 according to the present invention could conceivably be manufactured from any type of material or blend of materials, including rubber, plastic, fiberglass, metal, and/or other natural or synthetic materials.

Although the most common usage of the panel 10 is for roofing
20 applications, it may also be used for other applications, such as siding.

Referring to Figures 1 and 2, a panel 10 according to an embodiment of the invention includes decorative elements 12, the top and frontal visible surfaces of which may be characterized by simulated textures of wood shakes (cedar or otherwise), slate, stone, brick,
25 concrete tile, Spanish tile, Italian tile, other tile patterns, or any other effects. Many other designs may be imparted to the visible surfaces as may be required. The panel 10 may be colored to numerous synthetic colors to emulate natural colors – for example, greys, black, or browns.

30 Although each panel 10 is a unitary member, the decorative elements 12 are preferably separated by gaps 14 to give the appearance

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of discrete shakes, tiles, or other natural materials affixed adjacently. The decorative elements 12 are preferably staggered so that their frontal faces 16 form an irregular pattern when viewed from the top. This irregular pattern avoids the artificial appearance that the frontal faces 16 would present if they were perfectly aligned. As noted, the frontal faces 16 may also have simulated textures imparted to them to provide integrity and consistency with corresponding simulated textures imparted to the top surfaces 18 of the decorative elements 12.

Although each panel 10 could conceivably include just one decorative element 12, the panel 10 preferably includes a plurality of decorative elements 12. For example, each panel 10 can have a single row of three to five decorative elements 12 in the form of simulated shakes or tiles. A typical panel 10 with a single row of about three to five simulated shakes or tiles can be, for example, made about 16 inches by 40 inches (40 cm. by 100 cm.), with an exposed surface when installed of about three square feet (300 square cm.) and a thickness of about 1.8 inches (4.5 cm.) at the thickest protrusion. A panel 10 of this approximate size, combined with the general lightweight nature of such panels 10, make the panels 10 easy to carry, position, align, and install, thereby cutting labor costs and installation times. It is possible for each panel 10 to have a plurality of rows of decorative elements 12 rather than just a single row. However, if the overall size of the panel 10 is to be maintained at about 16 inches by 40 inches (40 cm. by 100 cm.), each decorative element 12 would then need to be made smaller, which might be desirable for some applications but the decorative elements 12 might then no longer simulate the sizes and proportions of actual shakes and tiles commonly found in building applications. Alternatively, the size of the panel 10 can be made larger, but this should be balanced against having a panel 10 sized for optimal ease of carrying and installation.

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Referring to Figure 1, each panel 10 has a nailing flange 20 along its rear edge. The nailing flange 20 has recessed indicators 22 to show preferred locations where fasteners may be inserted to affix each panel 10 to an underlying substrate. Fasteners, for example nails or screws, may be used to fasten a panel 10 to a substrate or structure at one or more of each recessed indicator 22.

Figure 3 is a bottom plan view of a panel 10 according to an embodiment of the invention. As shown in Figure 3, a panel 10 according to this embodiment is not of solid construction, but is preferably hollow other than a network of structural supports that run between the outer edges of the panel 10. In particular, a network of longitudinal supports 24 which run from one side of the panel 10 to the other side, and transverse supports 26 which run from the front of the panel 10 to the back, form an overall structure that allows for contact and support of the panel 10 to the substrate to which it is fastened without the need for the panel 10 to be completely solid. The structure formed by the longitudinal supports 24 and the transverse supports 26 distributes any weight or forces of pressure that may be imparted to the top surface of any panels 10 and evenly dissipates those pressures to the substrate, whether such pressures are caused by elemental forces such as wind or by someone walking on the panel 10, all without causing damage to the integrity of the panel 10 or the substrate. The longitudinal supports 24 and transverse supports 26 provide strength and integrity to each panel 10, but allow the panel 10 to be manufactured using less material, while achieving a more lightweight panel 10 that is both easier to install and easier for the substrate or underlying structure to support. The structural supports need not be in a grid pattern as shown in Figure 3; any other pattern that similarly distributes weight and pressure will also be effective, although a grid pattern allows for simpler and more cost-effective manufacturing.

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Referring to Figures 3, 5, and 8, structural cavities **25** created by the multiple intersections of longitudinal supports **24** and transverse supports **26** also enhance the isolative qualities of the panel **10** by encapsulating pockets of air which become part of the natural insulation mechanism of the panel **10**. Along with the thermal qualities of the composition of the preferred materials used in the manufacture of the panels **10** themselves, the air pockets within the plurality of structural cavities **25** give the panels **10** further isolative qualities which assist in cost savings in the heating and air conditioning of buildings on which panels **10** are interconnected into roofing or siding systems in hot or cold climatic areas.

As best shown in Figures 5 and 8, the longitudinal supports **24** and transverse supports **26** are preferably slightly recessed from the bottom of the panel **10** relative to the outer edges of the panel **10** – in particular, the side edges; this permits movement of the air pockets trapped under the panel **10**. Accordingly, the slightly recessed longitudinal supports **24** and slightly recessed transverse supports **26** together form a structure which both provides structural support to the panel **10** and assists in the dissipation of any built-up moisture underneath the panel **10** that may be created by moisture vapor which may percolate from the substrate or otherwise, thereby resisting damage caused by moisture in the form of damp rot, fungus or mold which proliferate in areas of dampness. In other words, the longitudinal supports **24** and transverse supports **26** provide both an effective support structure as well as an integrated venting system for the panels **10**.

In addition, as shown in Figures 2, 3, and 5, a plurality of slots **27** in the bottom surface of each panel **10** near its front and rear edges connect air pockets that may otherwise be trapped beneath each panel **10** to pass to adjacent panels **10** to which they are connected, thereby creating a complete and integrated insulating air blanket under a system

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of interconnected panels **10** to further alleviate the chance of any moisture or vapor build up under a system of interconnected panels **10**.

Such systems of interconnected panels **10** are shown in Figures 4 to 7. As shown in Figures 4 to 7, a plurality of panels **10** can be connected together to form an interconnected system of panels, interconnected both in a side-to-side manner and in a front-to-back manner. With respect to the front-to-back connectivity, each panel **10** has an element of a longitudinal locking mechanism along its length near each of its front and rear edges that allows it to interlock with an adjacent panel **10** in front of it or behind it. With respect to the side-to-side connectivity, each panel **10** preferably also has a transverse locking mechanism on its sides that allows it to interlock with an adjacent panel **10** to its side. Both the longitudinal locking mechanism and the transverse locking mechanism will be described in more detail below.

Referring to the cross-sectional side views of the panel **10** in Figures 8, 9, 11, and 12, a longitudinal protrusion **28** extends upwardly from the panel **10** in front of the nailing flange **20**, and forwardly toward the frontal faces **16**. Referring to Figure 1, the longitudinal protrusion **28** preferably runs the length of the panel **10** near the rear edge of the panel **10** but in front of the nailing flange **20**. This longitudinal protrusion **28** forms one half of a longitudinal locking mechanism that permits a panel **10** to be longitudinally interlocked with an adjacent panel **10**. In particular, the longitudinal protrusion **28** of one panel **10** interfits and interlocks with a corresponding longitudinal cavity **30** near the frontal faces **16** of an adjacent panel **10**, as shown in Figures 11 and 12.

Referring to Figures 10 to 12, the underside of each panel **10** has an indented region **32** proximate to the frontal faces **16** of the panel **10**. The indented region **32** of each panel **10** is adapted to receive and encompass both the longitudinal protrusion **28** and the nailing flange **20** of the adjacent panel **10** in front of it. Each indented region **32** has

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within it a longitudinal cavity 30 which interfits with and interlocks, in a latching manner, with the longitudinal protrusion 28 of the adjacent panel 10 in front of it. During installation, after the frontmost of two adjacent panels 10 is fastened through its nailing flange 20 to the underlying substrate, the indented region 32 of the rearmost of the two panels 10 can be placed over both the longitudinal protrusion 28 and nailing flange 20 of the frontmost panel 10 and then pulled backwards until its longitudinal cavity 30 has interfitted and interlocked with the longitudinal protrusion 28 of the adjacent panel 10 in front of it. Once the longitudinal cavity 30 of the rearmost panel 10 is interlocked in a latching manner with the longitudinal protrusion 28 of the adjacent panel 10 in front of it, the resulting longitudinal locking mechanism prevents the two interlocked panels 10 from moving perpendicularly away from each other. The indented region 32 also, when the panel 10 is viewed from the side, encompasses and protects the nailing flange 20 of the panel 10 in front of it against elements such as water, wind, or wind-driven rain. Further, once the rearmost of the two panels 10 has also been fastened to the underlying substrate along its nailing flange 10, the longitudinal locking mechanism prevents both backward movement of the panel 10 as well as upward movement that might otherwise be caused by wind uplift and rain near its frontal faces 16, without the need for additional fasteners near the front of the panel 10.

Referring to Figures 3, 5, 7, 8, 10, and 12, further resistance to elemental forces is preferably provided by a plurality of additional cavities 34 along the underside of the panel 10, running strategically along the full length of the frontal faces 16 of the panel 10. Each such cavity 34 creates a vacuum break which disrupts any wind-driven rain or water that may pass along the underside of the panel 10, thereby resisting the hazardous effect such elements could potentially cause, and draining the water naturally away.

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Referring to Figure 12, any wind-driven rain or water that somehow penetrates under the panel 10 past the cavities 34 is then stopped by the longitudinal locking mechanism formed by the longitudinal cavity 30 of the panel 10 interfitting and interlocking with the longitudinal protrusion 28 of the adjacent panel 10 in front of it, which together create a water-resistant joint which provides further resistance from wind-driven rain or other elements which might otherwise penetrate under the panel 10. This longitudinal locking mechanism also protects the nailing flange 20 of the front panel 10 and the fasteners used to secure that panel 10 through nailing flange 20 to the underlying substrate. For even further protection, as shown in Figures 8, 11 and 12, each panel 10 can have a water stop 36 along the full length of its rear edge behind its nailing flange 20, to further prevent moisture from penetrating past the water stop 36 to reach the underlying substrate. As shown in Figures 11 and 12, the longitudinal protrusion 28 of one panel interfits and interlocks with the longitudinal cavity 30 of an adjacent panel in a manner that adds strength to the system of interconnected panels 10 and that increases in strength with any exterior force that causes lift, such as wind.

As shown in Figures 4 to 7, the configuration of the longitudinal locking mechanism, namely, a substantially continuous longitudinal protrusion 28 to which a corresponding longitudinal cavity 30 of one or more adjacent panels 10 can be latched at an indefinite number of points along the length of the longitudinal protrusion 28, allows for a continuous side-to-side adjustment of adjacent rows of interlocking panels 10 to achieve a laterally staggered effect, and prevent the proliferation of any ongoing noticeable repetitive design which may have a negative appeal to the look of the visual elements of the panels 10 when used in a system of such panels 10.

In addition to a longitudinal locking mechanism for allowing a plurality of panels 10 to be interlocked together in a front-to-back manner, a transverse locking mechanism is also desirable for allowing

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panels 10 to be interlocked together in a side-to-side manner. Having a transverse locking mechanism to interlock panels 10 together in a side-to-side manner is preferable to simply laying the panels 10 next to one another since interlocking provides improved protection of the underlying substrate from the elements. If desired, the transverse locking mechanism of each panel 10 can take a similar latching arrangement as the longitudinal locking mechanism described above. However, given that the longitudinal locking mechanism already serves to prevent upward movement of each of a system of interlocked panels 10, and given that fasteners through the nailing flange 20 already serve to restrain side-by-side movement, the transverse locking mechanism of the panels 10 can take a simpler form than the longitudinal locking mechanism if desired, and need not be a latching arrangement similar to the longitudinal locking mechanism. For example, the transverse locking mechanism of the panels 10 can take the form of a simple hook and lap arrangement.

Figures 1, 2, 3, and 13 show one possible embodiment of a transverse locking mechanism. In the example in Figures 1, 3, and 13, the transverse locking mechanism consists of a transverse protrusion 38 extending upwardly from a panel 10 along its right edge and a corresponding transverse cavity 40 on the underside of an adjacent panel 10 along its left edge. The transverse protrusion 38 of one panel 10 interfits and interlocks with the transverse cavity 40 of the adjacent panel 10 to form an interlocking joint that resists moisture penetration of the system of interlocked panels 10. This transverse locking mechanism provides yet further protection against damaging water or moisture ingress into the underside of a system of interlocked panels 10.

Still further protection against the elements is preferably built into each panel 10 in the form of a reservoir cavity system located where the longitudinal locking mechanism of a panel 10 intersects the transverse locking mechanism. Referring to Figure 1, a recessed water reservoir

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42 extends downwardly from the top of a panel 10 at its right, rear corner. Referring to Figure 3, a corresponding reservoir protrusion 44 extends downwardly from the underside of a panel 10 at its left, rear corner. The reservoir protrusion 44 of one panel 10 is adapted to
5 interfit and interlock into the water reservoir 42 of an adjacent panel 10 to its left. The water reservoir 42 of one panel 10 cooperates with the reservoir protrusion 44 of the adjacent panel 10 to allow for the draining of any moisture that may penetrate or wick between the end of the longitudinal protrusion 28 of the first panel 10 and the opposing end of
10 the longitudinal protrusion 28 of the adjacent panel 10. In particular, any such moisture in the water reservoir 42 drains down into an adjacent exposed drain gap 46 where it can simply run off the panel 10. The reservoir protrusion 44 interfits and interlocks into the adjacent water reservoir 42 to also create a tight bond and positioning mechanism,
15 which assists to keep the ends of two adjacent panels 10 in tight contact and position with respect to each other, especially in cooperation with the transverse locking mechanisms of those panels 10. The interlocking of the transverse protrusion 38 and the transverse cavity 40 also facilitates additional alignment and tightness of placement between two
20 adjacent panels 10.

Of course, it will be realized that the transverse protrusion 38, the water reservoir 42, and the drain gap 46 could similarly be located on the left edge of the panel 10, in which case the corresponding transverse cavity 40 and reservoir protrusion 44 would be located on the right edge
25 of the panel 10. As long as the transverse protrusion 38 is on an opposite side edge to the transverse cavity 40, and the water reservoir 42 and an adjacent drain gap 46 are on an opposite side edge to the reservoir protrusion 44, these elements will function as intended.

To install a system of panels 10, one should first remove any pre-
30 existing cladding material from the underlying substrate or structure, and then cover the substrate with a suitable underlayment. Beginning at

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the lowest edge of the roof or other substrate, one should then install a starter strip (not shown) that replicates only the rearmost, normally not visible, portion of a panel 10. In particular, such a starter strip includes elements equivalent to the nailing flange 20, longitudinal protrusion 28, and water stop 36 of a panel 10, but not the decorative elements 12.

5 The starter strip can be, but need not be, the same length as the panels 10 being used in the same installation; also, the starter strip can be, but need not be, made of the same material as the panels 10. For example, the starter strip may be made of metal and extruded in a greater length
10 than the panels 10 being used in the same installation, which may be made, for example, of a blend of rubber and plastic. The starter strip may also incorporate and integrate along its front edge a drip edge element, which would be similar to drip edges or gutter aprons typically installed along the eaves and/or gables of conventional roofs. As
15 required, a series of such starter strips should be installed, by inserting one or more fasteners through the nailing flange of each starter strip, along the length of the edge of the substrate with the longitudinal protrusion portion of each starter strip closest to the edge of the substrate and the water stop portion furthest away.

20 After installing one or more starter strips, as required, along the lowest edge of the substrate, a first row of panels 10 should then be interlocked to the installed starter strips by placing the indented region 32 of each of the row of panels 10 over the longitudinal protrusion and nailing flange portions of the starter strips and then pulling each of those
25 panels 10 backward so as to engage the longitudinal locking mechanism by latching the longitudinal protrusions of the starter strips into the longitudinal cavities 30 of the panels 10. Each panel 10 in the row should also be transversely interlocked with any adjacent panel 10 in the row by interlocking the transverse protrusion 38 of each panel 10 into
30 the transverse cavity 40 of the panel 10 to its right, and by interlocking the reservoir protrusion 44 of each panel 10 into the water reservoir 42

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of the panel **10** to its left. Each of the panels **10** in the row should then be fastened to the substrate by inserting suitable fasteners through one or more of the recessed indicators **22** in the nailing flange **20**. Once the first row of panels **10** has been installed, a second row can be installed by interfitting and interlocking the longitudinal cavities **30** of the panels **10** in the second row to the longitudinal protrusions **28** of the panels **10** in the first row, and by transversely interlocking those panels **10** within the second row together in the same manner as the first row, preferably in a manner where the decorative elements **12** of the second row are staggered with respect to the decorative elements **12** of the first row, and then fastening the second row of panels **10** to the substrate by inserting suitable fasteners through one or more of the recessed indicators in the nailing flanges **20** of the panels **10** in the second row. This procedure should be repeated for subsequent rows of panels **10** until the underlying substrate has been covered. Again, the panels **10** within each row should preferably be adjusted relative to panels **10** in adjacent rows to avoid any repeated patterns between adjacent rows that will result in an artificial overall appearance.

Figures 14 to 16 show longitudinally interlocked rows of transversely interlocked panels **10** installed on a roof. Referring to Figures 14 to 16, wherever the underlying substrate or structure experiences a change in direction, such as a gable, ridge, hip, or valley (not shown), which may result in any edges of panels **10** being otherwise exposed, accessory caps incorporating similar design features to the panels **10** may be used to cover those exposed edges. Referring to Figures 14 to 28, such accessory caps may, for example, include ridge caps **50** for use along horizontal ridges of a roof, as well as on gables; hip caps **70** for inclined hips of a roof; valley caps (not shown) for horizontal or inclined valleys of a roof; and edge caps (not shown) for edges of a roof (especially if the starter strip selected does not include an integrated drip edge). Such accessory caps, like the panels **10**, may have simulated

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textures imparted to their visible surfaces if desired to provide the appearance of natural materials.

Figures 17 to 22 show a ridge cap 50 for installation along a ridge of a roof over systems of interlocked panels 10 on either side of the ridge, to protect the edges of those panels 10. Such a ridge cap 50 may also be used as a gable cap, to protect the edges of panels 10 where they end at a gable or rake of a roof. In the same manner as the panels 10, each ridge cap 50 has a nailing flange 52 with recessed indicators 54 to show preferred locations through which fasteners may be inserted to affix each ridge cap 50 to the underlying substrate. The nailing flange 52 is analogous to the nailing flange 20 of a panel 10. Referring to Figures 17, 20, and 22, each ridge cap 50 has a ridge cap protrusion 56 extending upwardly and forwardly from its top surface in the same manner as the longitudinal protrusion 28 of a panel 10. Referring to Figure 22, a corresponding ridge cap cavity 58 in the underside of the ridge cap 50 is adapted to receive the ridge cap protrusion 56 of an adjacent ridge cap 50. The ridge cap protrusion 56 of a ridge cap 50 interfits and interlocks, in a latching manner, with the ridge cap cavity 58 of the ridge cap 50 behind it, in a manner that protects the nailing flange 52 from the elements.

Similar to the panel 10, the ridge cap 50 is preferably not of solid construction, but rather has a network of longitudinal supports 60 and transverse supports 62 which are slightly recessed from the bottom of the ridge cap 50 relative to the outer edges of the ridge cap 50 (in particular, the side edges). This provides both structural support and improved insulation value by providing an integrated blanket of air underneath a system of interlocked ridge caps 50 covering a ridge of the roof and the systems of interlocked panels 10 on either side of the ridge; where used as a gable cap, this provides an integrated blanket of air underneath the system of interlocked ridge caps 50 covering the gable and the system of interlocked panels 10 that end at that gable.

Figures 23 to 28 show a hip cap 70 for installation along a hip of a roof over systems of interlocked panels 10 on either side of the hip, to protect the edges of those panels 10. Although each hip cap 70 has a hip cap cavity 78 in its front underside in the same manner that the ridge cap 50 has a ridge cap cavity 58 in its front underside, the hip cap 70 need not have a fixed, integrated corresponding protrusion near its rear top surface for latching with the hip cap cavity 78. Unlike the ridge cap 50 which is intended for a horizontal ridge, the hip cap 70 is intended for hips having a variety of possible pitches. Accordingly, a hip cap 70 which does not include an integrated latching protrusion near its rear edge, allows greater flexibility for adjustment to a variety of roof pitches. After each hip cap 70 has been adjusted to the particular pitch of the hip and installed on that hip, a separate removable locking mechanism (not shown) is installed near the rear edge of the hip cap 70, the separate removable locking mechanism having a protrusion adapted to interfit and interlock with the hip cap cavity 78. A subsequent hip cap 70 can then be interlocked behind that first hip cap 70 by interfitting and interlocking the hip cap cavity 78 of that subsequent hip cap 70 with the separate removable locking mechanism installed onto the first hip cap 70. In other words, hip cap 70 has a hip cap protrusion that interfits and interlocks with its hip cap cavity 78, but that hip cap protrusion (unlike the ridge cap protrusion 56 integrated into the ridge cap 50) is both removable from and re-attachable to the hip cap 70, in order to allow hip cap 70 to be easily adjusted to a wide variety of pitches of hips. While it is possible to manufacture the ridge cap 50 in a similar manner with a removable and re-attachable ridge cap protrusion 56, this would add an additional step into the installation of the ridge cap 50 and is typically unnecessary in respect of the installation of a ridge cap 50 onto a horizontal ridge or onto a gable.

Similar to the ridge cap 50 and the panel 10, the hip cap 70 is preferably not of solid construction, but rather has a network of trans-

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verse supports **82** which are slightly recessed from the bottom of the hip cap **70** relative to the outer edges of the hip cap **70** (in particular, the side edges); if desired, the hip cap **70** can also have longitudinal supports (not shown) similar to the ridge cap **50** and the panel **10**. This provides both structural support and improved insulation value by providing an integrated blanket of air underneath the system of interlocked hip caps **70** covering the hip of the roof and the systems of interlocked panels **10** on either side of the hip.

Like a panel **10**, and for the same reasons set out above in respect of the panels **10**, accessory caps like the ridge cap **50** and the hip cap **70** are preferably manufactured from a blend of recycled rubber tire crumb and recycled industrial polymers such as polyethylene and polypropylene or other virgin plastics. Even so, such accessory caps could conceivably be manufactured from any type of material or blend of materials, including rubber, plastic, fiberglass, metal, and/or other natural or synthetic materials.

The ridge cap **50** and hip cap **70** are preferably manufactured so that they are easily adjustable to any roofing application. For example, the ridge cap **50** is preferably formed in one piece, in the angle(s) most prevalent on sloped roof structures, but each ridge cap **50** preferably has a hinge **64** along its longitudinal center for adjusting the ridge cap **50**. The hinge **64** is preferably simply a portion of the ridge cap **50** along its longitudinal center that has been deliberately formed of lesser thickness than the "flaps" surrounding the hinge **64** on either side, in order to allow the ridge cap **50** to flex and adjust to various degrees larger or smaller than the prevalent angle(s). Preferably, the hinge **64** will permit adjustment of about between 10 to 20 degrees or more, but not so much that it degrades the strength of the ridge cap **50**. The hip cap **70** preferably has an analogous hinge **84** for adjusting the hip cap **70** in a similar manner as the ridge cap **50**.

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In conventional roofing applications, valley flashing is typically installed onto each valley of the roof or other substrate prior to installing the exterior roofing material, but no other covering is applied onto a valley after the exterior roofing material has been installed on either side of the valley. In respect of the present invention, valley flashing would similarly typically be installed onto a valley of the substrate prior to installing systems of interlocked panels 10 on either side of the valley. Optionally, a system of interlocked accessory caps could also be installed onto the valley after installing those systems of interlocked panels 10, to further protect the edges of the panels 10 that meet along the valley. As will be apparent to those skilled in the art in light of the descriptions above and drawings of the ridge cap 50 and the hip cap 70, a valley cap can be created for horizontal valleys by inverting the design of the ridge cap 50 and for inclined valleys by inverting the design of the hip cap 70. Similarly, accessory caps could be created using the same principles for any edge of a roof, whether gabled or otherwise. As will be further apparent to those skilled in the art in light of the examples in Figures 14 to 28, accessory caps embodying aspects of the invention can take an infinite number of forms to suit any change in direction on the surface of a roof or other substrate or structure.

As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.